IN THE CLAIMS:

1. (Previously Presented) A method for determining a current distribution of an object, the method comprising:

measuring the magnetic fields in vicinity of the object using a multi-channel measurement device that measures an irrotational and sourceless vector field, whereby one measurement sensor corresponds to each channel;

converting a multi-channel measurement signal corresponding to each measurement sensor into ~~the~~ signals of a predetermined set of virtual sensors; and

determining the current distribution of the object being measured from the signals of the set of virtual sensors in a predetermined function basis to be efficiently calculated.

2. (Currently Amended) The method according to claim 1, wherein the object is approximated using a ~~spherical harmonic~~ conductor, and a multi-pole ~~development~~ expansion of the field is calculated from the multi-channel measurement signal.

3. (Currently Amended) The method according to claim 2, wherein the multi-pole ~~development~~ expansion is calculated by taking into account magnetic fields emitted by sources outside the object.

4. (Currently Amended) The method according to claim 2, wherein the multi-pole ~~development~~ expansion is calculated by ignoring magnetic fields emitted by sources outside the object.

5. (Previously Presented) The method according to claim 2, wherein external interferences are eliminated prior to the step of converting.

6. (Currently Amended) The method according to claim 2, wherein as an orthonormal function basis, a current distribution equation of the following form is selected:

$$\cancel{\overset{\rho}{J}(\overset{\rho}{r}) = \sum_{l=0}^{L}\sum_{m=-1}^{l} c_{lm} f(r) \overset{\rho}{X}lm(\theta,\varphi),}$$

$$\vec{J}(\vec{r}) = \sum_{l=0}^{L}\sum_{m=-1}^{l} c_{lm} f_l(r) \vec{X}lm(\theta,\varphi),$$

wherein c_{lm} are coefficients of the current distribution, $\cancel{f(r)}$ $f_l(r)$ is a freely selectable radial function and $\cancel{\overset{\rho}{X}lm(\theta,\varphi)}$ $\vec{X}lm(\theta,\varphi)$ is vector spherical harmonic.

7. (Currently Amended) The method according to claim 4, wherein:

an orthonormal function basis is placed into a current distribution equation; and

coefficients of the current distribution are analytically solved from the equation:

$$\cancel{C_{lm} = \hat{\gamma}_l M_{lm}\left[\int_0^R r^l f(r)dr\right]^{-1},}$$

$$C_{lm} = \hat{\gamma}_l M_{lm}\left[\int_0^R r^{l+2} f_l(r)dr\right]^{-1},$$

wherein $\cancel{\gamma_l}$ $\hat{\gamma}_l$ is a constant associated with order 1, M_{lm} are multi-pole coefficients, ~~and~~ R is a radius of a sphere to be examined, and $\cancel{\overset{\rho}{X}lm(\theta,\varphi)}$ $f_l(r)$ is a freely selectable radial function ~~spherical harmonic~~.

8. (Previously Presented) The method according to claim ~~4~~ 6, wherein function $\cancel{f(r)}$ $f_l(r)$ is used to adjust a depth weighing of a current distribution model.

9. (Currently Amended) A measurement device for determining a current distribution of an object by measuring magnetic fields in a vicinity of the object, the measurement device comprising:

a set of measurement channels ($1, 1^1, 1^2, \ldots 1^n$) that measure ~~an irrotational and sourceless~~ a curl free and divergence free vector field, in which case at least one measurement sensor $2, 2^1, 2^2, \ldots 2^n$ corresponds to each channel;

processing means for processing a measurement signal in which the object is approximated using a spherical-symmetrical conductor, wherein

the processing means include a conversion module for converting a multi-channel measurement signal corresponding to each measurement sensor into signals of a predetermined set of virtual sensors, which sensors are mutually orthogonal; and

calculation means for determining the current distribution of an object being examined from the set of virtual sensors using depth r in a predetermined orthonormal function basis.

10. (Currently Amended) The measurement device according to claim 9, wherein the calculation means are arranged to calculate a multi-pole ~~development~~ expansion from the multi-channel measurement signal.

11. (Currently Amended) The measurement device according to claim 10, wherein the multi-pole ~~development~~ expansion is calculated by taking into account magnetic fields emitted by sources outside the object being measured.

12. (Currently Amended) The measurement device according to claim 10, wherein the multi-pole ~~development~~ expansion is calculated by ignoring magnetic fields emitted by sources outside the object being measured.

13. (Currently Amended) The measurement device according to claim 10,

wherein as the orthonormal function basis, a current distribution equation with the following form is selected:

$$\cancel{\vec{J}(\vec{r}) = \sum_{l=0}^{L}\sum_{m=-l}^{l} c_{lm} f_l(r) \vec{X}lm(\theta,\varphi),}$$

$$\underline{\vec{J}(\vec{r}) = \sum_{l=0}^{L}\sum_{m=-l}^{l} c_{lm} f_l(r) \vec{X}lm(\theta,\varphi),}$$

wherein $\cancel{f(r)}$ $\underline{f_l(r)}$ is a radial function to be freely selected <u>and $\vec{X}\,lm(\theta,\varphi)$ is vector spherical harmonic</u>.

14. (Currently Amended) The measurement device according to claim 12, wherein

the orthonormal function basis is placed into the current distribution equation; and

coefficients of the current distribution are solved analytically from the equation:

$$\cancel{C_{lm} = \hat{\gamma}_l M_{lm}\left[\int_0^R r^l f(r)dr\right]^{-1}},$$

$$\underline{C_{lm} = \hat{\gamma}_l M_{lm}\left[\int_0^R r^{l+2} f_1(r)dr\right]^{-1},}$$

wherein $\cancel{\gamma_l}$ $\underline{\hat{\gamma}_l}$ is a constant associated with order 1 and R is a radius of a sphere to be examined <u>and $f_l(r)$ is a radial function to be freely selected</u>.

15. (Currently Amended) The measurement device according to claim 13, <u>wherein</u> $\cancel{f(r)}$ $\underline{f_l(r)}$ is used to adjust a depth weighing of a current distribution model.

16. (Previously Presented) The measurement device according to in claim 9, wherein the measurement device converts the signals into a set of virtual sensors prior to storage, and analysis software converts the stored data into a current distribution.

17. (New) The method according to claim 2, wherein the object is approximated using a spherically symmetric conductor.

18. (New) The method according to claim 9, wherein the object is approximated using a spherically symmetric conductor.